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Recent Meetings of the Sugar Experiment Stations Advisory Board.

THE personnel of the Advisory Board at present is as follows:—Chairman, the Minister for Agriculture and Stock (Hon. H. H. Collins); Millers' Representatives, Messrs. J. W. Inverarity (also Deputy Chairman) and A. V. Thorp; Growers' Representatives, Messrs. B. Foley and J. A. Winter, and the Director of the Bureau, Mr. A. F. Bell. The present Chairman succeeded the Hon. T. L. Williams, when the latter was allotted the portfolio of Education after changes in Cabinet early this year.

Since March, 1945, three meetings of the Board have been held and the following is a résumé of the proceedings:—

Meeting at Brisbane, 15th March, 1945.

In connection with the staff of the Bureau, the Board expressed its concern at the delay in appointing a successor to the Director, Dr. H. W. Kerr, who had recently resigned. It also agreed that steps should be taken immediately for the appointment of an engineer and other officers.

A deputation to the Board from the Mackay Cane Pest and Disease Control Board led to a discussion on the policy of the extra payment for beetles when two flights occurred in the one calendar year. Payments for wallaby scalps in the Mulgrave area and for beetles in the Tully area were also considered.

After a brief discussion on mechanical harvesters it was decided that the next meeting be held at Ayr to enable members to be present at the proposed demonstration of the Toft harvester in that district.

Meeting at Ayr, 26th June, 1945.

Because of changes in the itinerary of the demonstrators of the harvesting machines it was not practicable to arrange the holding of this meeting to coincide with the Ayr demonstration. Mr. J. A. Winter was unavoidably absent as it was necessary for him to attend the harvesting demonstration at Innisfail, whilst the Assistant Director represented the Director who with the unanimous approval of the Board was attending a fertilizer meeting in Melbourne.

A report by the Director on the desirability of establishing an Experiment Station in the Burdekin district was considered and members inspected several locations with this end in view. Conditions in the Burdekin district differ so markedly from those in the districts where stations already exist that the Board strongly recommended that a new station be established, particularly for the purpose of breeding canes suitable for irrigated conditions.

The Board then considered a detailed report on the staff reorganisation of the Bureau. It recommended that steps be taken immediately to fill the various vacancies as it was greatly concerned with the serious depletion of the staff during the war years.

Variations in published sugar production statistics received attention and the Board recommended that a meeting of the interested authorities be convened with a view to the elimination of the irregularities.

Finally the Board examined and approved the financial estimates for the year 1945-46.

Meeting at Brisbane, 18th March, 1946.

All members were present at this meeting and the Deputy Chairman, Mr. Inverarity, welcomed the new Chairman, the Hon. H. H. Collins.

Discussion ensued on the several vacancies that still existed on the staff of the Bureau and the Board recommended that immediate action be taken towards filling them.

Consideration was again given to the proposed establishment of an Experiment Station in the Burdekin district and the Deputy Chairman was asked to make further enquiries.

The Director pointed out that in connection with seedling work, conditions at Meringa were not entirely suitable for the selection of canes for the wetter areas. The Board agreed that it would be desirable to establish a sub-station in the wet areas and asked the Director to investigate suitable locations.

The Board expressed concern at the delay in the establishment of a Post Graduate course in Sugar Technology at the University of Queensland.

Several matters relating to Cane Pest and Disease Control Boards, including recommendations from the Queensland Cane Growers' Council, were discussed and the revival of Pest Control Conferences and the revision of the Cane Growers' Handbook were recommended.

NOTICE TO GROWERS.

For the convenience of growers, the names, addresses, and telephone numbers of the field officers of the Bureau are listed on the inside of the front cover. Growers are invited to submit their enquiries on all phases of sugar cane cultivation and pest and disease control to the nearest field officer or Sugar Experiment Station.

Cane Grub Control and Current Investigations.

BY R. W. MUNGOMERY.

CANE beetle and grub pests are attacked by many parasites and predators including birds, bandicoots, toads and numerous different insects, whilst diseases and climatic variations may reduce populations still further. Their combined effect usually ensures that the white grub populations remain at a comparatively low level, with the result that most cane crops seldom suffer severe damage. Unfortunately, this happy balance is occasionally upset and a sudden increase in the number of pests attacking the cane roots follows. Unless checked, the increased numbers of white grubs will seriously harm the crop and may even ruin it entirely.

The grower cannot depend on natural control for crop protection, but should plan his farming programme so as to avoid grub infestation if possible, and to minimise losses should his field become infested. The following recommendations are set out for the guidance of those growers whose crops are, unfortunately, sometimes subject to grub attack. At the same time attention is drawn to some control practices which do not yield the results popularly attributed to them, and to detail some of the Bureau's more recent experiments in the destruction of cane grubs.

Efficient cultivation prior to planting is a well established method of scaling down the extent and degree of damage inflicted by "frenchi" and "Childers" cane grubs. When preparing the fields for planting, the aim should be to reduce grubs to such small numbers that they are unlikely to cause serious damage before the crop is due to be ploughed out again in the normal course of rotation. In this respect the high speed rotary hoe plays a most useful role in the cultivation of "grubby" fields. However, once the crop is planted and begins to grow, any subsequent tillage operations can have very little effect in destroying grubs under the cane stools. For this reason it is not practicable to control by cultivation the one-year cycle greyback grubs which infest central and northern canefields after the crops are well advanced.

Ploughing out and immediate replanting offers little scope for grub destruction, and this practice, except in cases of dire necessity, is roundly condemned.

From a superficial viewpoint, beetle collecting appears an attractive proposition, but actually even where this system is organised on a district-wide basis, the number of beetles so collected usually represents only a small proportion of the total number on the wing. If weather conditions are suitable infestation is likely to occur despite the best endeavours on the part of the collectors.

Late planting is still a fairly reliable method of avoiding grub damage. The reason for this practice is that the small growth of the late planted fields at the time of the beetle flight is usually less attractive to egg-laden beetles than are the taller earlier planted crops. However, care should be exercised when selecting a suitable variety for the late planting programme, so as to exclude all early and free-arrowing varieties.

Varieties differ markedly in their ability to withstand grub attack, and it is here that the so-called "resistant" varieties score heavily. This resistance may be due either to the large mass of roots produced in the first instance, or to the ability of the stool to renew its roots after the older ones have been severed. Another factor is that stools of a tall variety are usually more easily blown out of the the ground than are those of a shorter variety, when the root system is weakened. Hence, other qualities being equal, the shorter, stout varieties are preferred in "grubby" areas. In this respect S.J.4 is a very valuable variety, but unfortunately it had to be excluded from the planting lists of many northern mill areas because of its high susceptibility to gumming disease.

P.O.J.2878 possesses outstanding merit in withstanding grub attack in the Mackay district, and its recent reintroduction should prove a valuable asset to that district in helping to combat moderate grub infestations. No variety, however, will stand up to very heavy grub infestation, and even the most hardy varieties will succumb under such conditions. Consequently, the grower must then resort to soil fumigation or else suffer crop losses.

Soil fumigation against cane grubs was originally carried out by injecting carbon bisulphide into the soil at the base of the cane stool, when the grubs were reasonably concentrated in the dense root zone close to the stools. A tendency developed in pre-war years to utilise a mixture of carbon bisulphide and paradichlorbenzene for cane grub fumigation, but the dichlorbenzenes tend to be harmful to cane growth. Although the mixture may kill a higher percentage of grubs than carbon bisulphide alone, this slight advantage does not always outweigh its greater depressing effect on the subsequent growth of the cane stools.

Carbon bisulphide was used with very good results during the war years, when it was impossible to obtain P.D.B., and it fulfilled the requirements of a fumigant for the majority of soils. There were exceptions in the very loose friable red volcanic soils and the very tight wet soils, but, despite this, it is problematical whether the mixture will again be used to any large extent.

A notable advance in the application of fumigant to the soil came with the introduction of the Blundell knapsack fumigant injector, whereby the acreage treated per day in many instances increased by 50 per cent. This was quickly followed by the Blundell machine injector which was designed to inject along one side of the cane row and it then became possible to treat three acres per day. The new machine speeded up fumigation work considerably and rendered it less unpleasant, but there still remained the problem of waiting until the grubs concentrated sufficiently close to the stools to ensure their death after the fumigant was applied. Whilst waiting for the grubs to concentrate in this manner, heavy rains or cyclonic weather were liable to cause the cane to lodge badly or make the land too wet to carry the implement. Thus, these fields often had to be fumigated eventually by the hand injector or else abandoned.

With these considerations in mind, Bureau entomologists are now working to perfect a system of fumigating the middle of the interspace, and the two extreme edges adjacent to the cane rows, in the one operation—that is, triple-line fumigation along the interspace. This aims at killing all the grubs in the interspace, irrespective of whether

they have moved in towards the stool or not, and would enable fumigation campaigns to be carried out earlier than is now practicable. Theoretically, fumigant delivered in this manner should blanket the soil throughout the whole field with poisonous gases, in contrast to the previous method of confining fumigation to the row itself. The destruction of the grubs weeks earlier would be highly advantageous because fumigation campaigns could be completed in many districts before the onset of the wet season. Small scale field trials have demonstrated the practicability of such a plan, and negotiations are now in progress for the building of a machine to perform this work.

Elsewhere in this Bulletin (page 6) reference is made to the recent experiments in which "Gammexane" gave successful control of cane grubs in small field trials this year, and further investigational work is planned for the coming season to increase our knowledge of the value of this new chemical for cane grub destruction.

Generally speaking, the position of cane grub control by means of insecticides is in a state of flux at the present time, but both triple-line fumigation and "Gammexane" offer promising avenues for improving our present day practices for grub control.

Field Days.

The Advisory Board, at a meeting held in March, decided that the annual field days at the Experiment Stations should be resumed. The Board felt that these field days provided a valuable medium of contact with the growers and enabled them to gain first hand insight into some of the technical work of the Bureau.

It is necessary that such field days be held during the slack season as growers otherwise can ill spare a day from their harvesting and farming operations. Accordingly it has been the practice to hold the gatherings in June or thereabouts when farm operations are usually rather restricted and the seedlings and new varieties are in an advanced stage of growth.

Unfortunately the drought has been extremely severe at Bundaberg and in addition the irrigation water supply of the Station failed. Similarly at Meringa the drought has not only stunted the cane but has prevented fumigation, with dire results to experimental crops. Under these circumstances, and in view of the short time available for organisation, it was reluctantly decided that field days could not be held at these stations.

As far as Mackay is concerned, the return of field officers from the armed forces has brought about long-delayed staff changes which are now being implemented and, although crop conditions are fair, an organised field day is not practicable. However, it may be anticipated that full scale field days will be held at each station prior to the 1947 crushing.

In the meantime growers are reminded that their personal visits to the Stations will be welcomed at any time.

A.F.B.

"Gammexane"—A Promising Chemical for Cane Grub Control.

BY R. W. MUNGOMERY.

DURING the late war years wide publicity was given to the new insecticide D.D.T., because of the wonderful results achieved with it in the control of mosquitoes, house-flies, bed bugs, lice and other insects known to be responsible for the spread of human diseases. With the end of the war supplies of this insecticide were soon released to the public and its efficacy in controlling many household pests was quickly realised. No less important has been its success in checking many plant pests more efficiently than the insecticides used previously. The outstanding success of D.D.T. stimulated investigations of the toxicity of many other materials to insects, and in consequence another notable insecticide, benzene hexachloride, or, as it is more popularly known, "Gammexane" or "666" has been produced.

This chemical was developed as a result of British wartime research, and it may ultimately prove as revolutionary in the control of some pests as the now well-known D.D.T. Benzene hexachloride was developed along with many other chemicals in an effort to replace such insecticides as pyrethrum and derris, which being vegetable products were expensive to produce, and short in supply. The chemical first showed promise in 1942 as a control for certain turnip pests in England and further examination of its pest-destroying properties led to its being called by the now familiar name "Gammexane." "Gammexane," in the pure state, is a colourless crystalline substance, and is capable of acting against insects as a stomach poison, a contact poison, and as a fumigant. From 1943 on, it was successfully tested againt a variety of pests, but its production was considerably in the leeway of D.D.T. and supplies of "Gammexane" are still somewhat limited.

However, through the courtesy of Imperial Chemical Industries, the Bureau was able to obtain a small amount for experimental purposes, and this was used in both laboratory and field tests against cane grubs.

Laboratory tests soon showed that "Gammexane" was highly toxic to cane grubs when incorporated in the soil in which the grubs were operating, but it was in the small exploratory field trials at the Northern Sugar Experiment Station that results were particularly outstanding. In these experiments "Gammexane" and D.D.T., in seperate treatments, were applied in the planting furrows or on the sides of the cane rows last November (before the beetle flight) in some well advanced cane where grub damage was anticipated. Both plant and ratoon crops of Badila were treated in this manner, and, as expected, grub infestation occurred in both blocks.

Stool diggings were carried out towards the end of April and results from the plant block were the most spectacular. These diggings revealed that the untreated control rows still carried an average infestation of between five and six large third stage grubs per stool. The cane was badly damaged and stunted, and showed the typical brown curled

tops, whilst the D.D.T. treated plots were no better in appearance, and still carried a heavy grub infestation. However, when the "Gammexane" treated plots were dug, the rooting system was intact and no live grubs were to be found under the stools. Moreover, the cane in the "Gammexane" treated plots was taller (Fig. 1), with leaves of a dark green colour, indicating that this cane had suffered no serious check from grub damage. These results were particularly encouraging, and demonstrated a high degree of grub control by "Gammexane" under the conditions of the trial.

FIG. 1.—Shows better growth of cane in plot where grub damage has been controlled by "Gammexane". Rows maked x on either side of "Gammexane" treated rows indicate marginal treatment effect.

"Gammexane" has many advantages. It is of negligible toxicity to humans; it is much less unpleasant to handle than carbon bisulphide, and there is no risk of fire injury in its use. Its persistence and residual effect in soil may prove an extremely valuable feature in conducting grub control campaigns. Although it is too early to give estimates of cost, trial work on the Northern Experiment Station indicates that its use would not be uneconomic, and if the results so far achieved in controlling cane grubs can be reproduced in more extensive experiments, there is no doubt that it will displace the fumigants now being used. Much more work yet remains to be done, however, before a final evaluation of this new insecticide can be made. Further investigations of the method and ease of application are required and an examination must be made of its possible toxic effects to sugar cane and green manure crops from its use in the soil. "Gammexane" certainly offers new hope for practical efficient cane grub control and with the release of larger amounts for experiments, knowledge of its value to the cane farmer should be considerably increased in the near future.

Attachments for the Blundell Mechanical Injector.

BY J. H. BUZACOTT.

SINCE the Blundell mechanical injector first appeared in the cane fields, several simple improvements to suit local conditions have been developed, and the opportunity is taken here to describe two of these, so that other users, whose particular problems warrant it, may benefit from the experience of those who have found the attachments an advantage.

FIG. 2.—The scraper for the main disc on the Blundell mechanical injector.

The first of these gadgets is a simple scraper for the main disc (Fig. 2). It has been found on some types of sticky red soil that the disc builds up badly with soil. This interferes with steering, causes the disc to cut too wide a furrow, and in some instances prevents it from entering the ground properly, thus making shallow injections. A piece of iron about nine inches long, one inch wide, and one-eighth of an inch thick, drilled and bolted to the cane plate at the front of the machine and bent in to the depression of the disc is quite successful in preventing this trouble. A broader scraper might be even more effective, but the type described has proved very satisfactory and does not offer sufficient resistance to stop the disc from revolving which a broader scraper surface might do. It is advisable to bolt the scraper to the inner side of the cane plate using plough bolts counter-sunk flush with the plate for attachment.

The second improvement is a guard for the near rear wheel (Fig. 3). Experience has shown, particularly when using a horse-drawn injector, that although the cane plate forces the disc assembly away from a stool out of alignment in the row, the rear wheel will often pass over one or two sticks of the stool and break them down. A guard for the near rear wheel entirely prevents this, and has proved a great advantage for use in very advanced or staggered cane. The

guard can be made in a variety of ways, but the particular one illustrated is built from one and a-half inch steel a quarter of an inch thick.

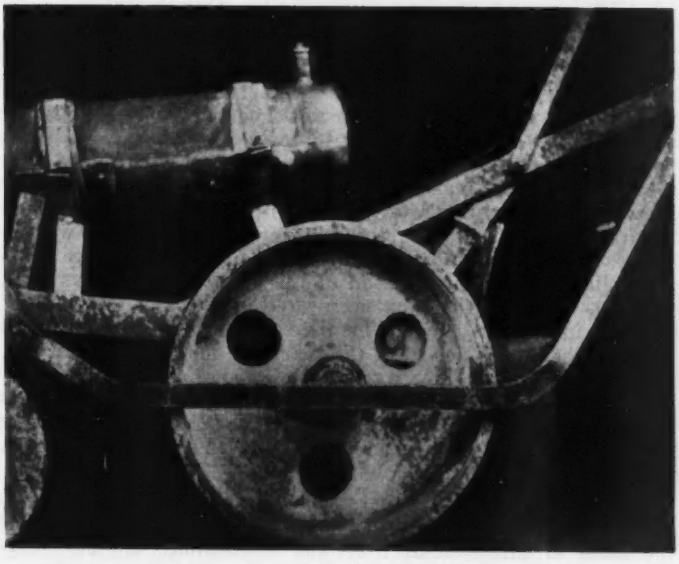

FIG. 3.—The guard for the rear wheel to prevent injury to cane stools when fumigating with the Blundell mechanical injector.

The principal argument against making additions to a machine is the increase in weight, but neither of the two attachments here described adds greatly to the weight, whilst their value, under conditions which warrant their use, is inestimable.

Storage of Fumigant Injectors.

Frequent inquiries are received seeking information concerning the storage of carbon bisulphide injectors for, although great care may be exercised in cleaning these machines, a certain amount of corrosion occurs when they are stored from one season to the next. This necessitates recleaning and scraping the injectors before putting them into operation each year.

By courtesy of the Information Section of the Council for Scientific and Industrial Research and the Munitions Supply Laboratories of the Department of Munitions, the following information regarding the reduction of corrosion has been made available:—

Corrosion should be greatly minimised by thorough washing in hot sodium carbonate (washing soda) solution, rinsing in clean boiling water, drying and coating with a proprietary preparation consisting of a solution of lanolin in white spirits. Supplies of this preparation may be obtained from the major oil companies.

J.H.B.

*The Blundell Mechanical Fumigant Injector.

By J. H. BUZACOTT.

SOME years ago a great improvement in the work of cane grub fumigation in Queensland was brought about by the invention of a new type of soil injector. The introduction of this injector, which is now known as the Blundell Knapsack Injector after its inventor, caused the area fumigated per man per day to be practically doubled and, coming into general use, as it did, just prior to the commencement of the Second World War, it served a doubly useful purpose by enabling comparatively large areas to be fumigated during the early war years even with the considerably reduced man-power available to farmers. Nevertheless, as the war carried on year after year, man-power shortages became more and more acute until during the last few years when it was almost impossible in most areas to obtain sufficient man-power to fumigate anything like an adequate portion of the grub-infested areas of North Queensland. This position was aggravated by the fact that hand fumigation is definitely not congenial work since it is, of necessity, carried out at the most humid period of the year and, more often than not, the operator must perform his work in tall cane where no breeze can penetrate; consequently men, who were prepared to work as fumigators during pre-war years, when competition for jobs was keen, were no longer available once they had an opportunity to select a less unpleasant occupation.

It was at this stage that there came on the market a mechanically-operated injector, drawn by either horse or tractor power and designed by the same inventive mind that was responsible for the Knapsack Injector. The Blundell Mechanical Injector is by no means a new invention; indeed it is now some fifteen years since the first unit of this type was constructed by Mr. Blundell. At that particular time a number of men were experimenting with horse-drawn injectors of one type or another and one design was even manufactured in numbers by a northern engineering firm. However, most of these early machines, though ingenious and frequently capable of working quite well in an ordinary open field, generally failed under the more exacting conditions required of successful fumigation at a period when the cane is well grown. The necessity for injecting the doses close to the cane stools, for dealing with heavy trash, for perfectly covering the injection furrow and consolidating the soil over it again, and in addition the necessity for a trouble-free, non-leaking pump, all proved obstacles for the would-be inventor. At this earlier period, when the use of the Blundell Mechanical Injector was first shown to be practical on a field scale, there arose another serious problem with which the machine had to contend. The country was faced at that time with a serious depression; labour was in over supply and wages were comparatively low. There was no difficulty in getting together a gang of able fumigators and consequently, although a suitable machine would have undoubtedly been most useful, there was not the necessary interest taken by farmers to ensure the successful development of a mechanical injector. It is not surprising, therefore, that inventors of that particular period temporarily lost interest in horse-drawn implements and that one of them should turn his ingenuity to the construction of an improved man-operated injector. In such a way was the Blundell Knapsack Injector evolved.

* Paper presented at the Bundaberg Conference, Q.S.S.C.T., April 1946.

With the advent of the Second World War and the consequent falling-off in the supply of farm labourers, the set-up changed considerably. Once again men with a flair for mechanics attempted to evolve different methods for the speeding up of fumigation work. These methods generally aimed at lightening the work for the operator and increasing the area treated per man day. Most of the schemes met with indifferent success, but it was undoubtedly this same set of conditions which induced Mr. Blundell to resurrect his earlier horse-drawn machine. With a certain amount of modification and using a narow track tractor to pull the implement he was able to demonstrate that he could fumigate his farm in a highly efficient manner using but two men for the work and covering the ground at the rate of approximately three acres per day.

Due to the altered circumstances which now obtained, Pest Boards and farmers showed immediate interest and representatives of many northern grub-affected districts travelled to see the machine in operation. Such interest was expressed that there is little doubt that the construction of the machine on a commercial scale would have been carried out forthwith by one of the larger manufacturers of agricultural implements. Unfortunately the wartime conditions which led to the revived interest in the machine also caused practically all manufacturers to be more than fully occupied with the making of essential wartime products. At this period, early in 1944, it certainly looked as if farmers would have to wait at least several years before the mechanical injector became available for purchase.

At this stage the Innisfail Cane Growers' Executive decided that, with their organisation for handling agricultural machinery, they might be able to construct the machines in Innisfail and thereby assist the cane farmers of the northern districts to carry on with their work in grub control. Accordingly a representative of the Innisfail Cane Growers' Executive came to an agreement with Mr. Blundell regarding patent rights, and construction of the machines was immediately commenced.

From this stage on, the success of the machine should have been assured. Quite a number of orders were received and, after experiencing considerable difficulty in obtaining many of the parts, the firm succeeded in delivering most of the ordered injectors to purchasers in time for a trial during the 1945 grub season. Trouble now began to develop. It was the wettest season experienced in North Queensland for many years and until late in the grub season, in some areas indeed until April, it was impossible even to work a man-operated pump in the field let alone a horse or tractor-drawn implement. When at last the trials could take place, many of the machines failed to work satisfactorily. In a normal year, when fumigation would have been commenced earlier, some experimental work could have been carried out by the purchasers to determine the cause of the unsatisfactory performance but, late in the season as it was, in most instances the machines were laid aside and hand pumps were resorted to in an endeavour to carry out as much of the fumigation campaign as possible before the cane became too badly damaged by the grub populations present. The time of Pest Board Supervisors was too fully occupied in chasing up labour and keeping hand injectors in order for them to be able to spend time in experimentation.

Whilst this happened in most cases a small amount of successful fumigation was carried out with the machine. By means of fitting a trash-lifting device, several acres were successfully fumigated at the Northern Sugar Experiment Station; nevertheless it was obvious that something was wrong with this machine also when its work was compared with the trouble-free operation given by Mr. Blundell's own machine.

During some of this period under review Mr. Blundell was away and it was not until late in the 1945 fumigation season that he had an opportunity of observing the faulty operation of the locally constructed machines. With other interested persons Mr. Blundell paid a visit to the Mourilyan area in order to see one of the faulty machines at work and it was not long before the discovery was made that practically the whole trouble was caused by a slight deviation, during manufacture, from the pattern of the disc assembly of the original.

Although this slight alteration had an unfortunate effect on the successful performance of the machine during its first appearance as a commercial product, and caused Pest Board supervisors and field chemists many hours of disappointing labour, the writer does not wish it to be thought that the blame lies at the door of the manufacturer. Actually the Innisfail Cane Growers' Executive is to be commended for even attempting to produce an implement under the circumstances, when both skilled labour and suitable materials were practically impossible to procure. Since discovering the cause of the trouble, Mr. Blundell has spent a considerable amount of his time in travelling to various areas and supervising the alteration of machines so that they will perform in the same efficient manner as his own.

The Blundell Mechanical Injector consists of a rectangular angle-iron frame, mounted on two heavy eighteen-inch diameter wheels at the rear and supported in front by a small-diameter adjustable depth wheel. The rear wheels are fixed to their axle (in some only the right rear wheel is fixed whilst the left hand one is free for ease in turning) and on this axle is a five-toothed cam wheel which operates a cam lever pivoted on the main frame. This cam-lever is connected to the plunger of a pump in such a way that when the cam is struck by the cam wheel, it withdraws the pump plunger against the tension of a powerful spring. When the cam slides over the lever, the shape of the tooth is such that the lever is released suddenly and the plunger flies forward into the pump barrel. During the backward stroke of the plunger, liquid is sucked into the pump through a mushroom type valve from the main tank, whilst on the forward movement of the plunger this valve closes and the liquid is expelled through a pipe leading to the assembly which is responsible for the correct orientation of the dosage in the soil. The pump has provision for adjusting the amount of liquid delivered at each stroke and there is also a patented device for tightening the leather pump washer in a few seconds without removing either the cylinder or the plunger. A long clutch lever, within easy reach of the operator, is provided, by which the pump can be thrown out of action when turning on headlands or if otherwise necessary. See Fig. 4.

The assembly through which the fumigant is actually placed in the ground is a most important one. It consists of a small saucer-shaped disc thirteen inches in diameter, which is fitted with a scraper and is

mounted low down on the left hand side of the machine towards the front. The disc is adjusted to cut in a vertical line with approximately one and a-half inches cut from front to rear. Behind the scraper, and attached so that it follows freely along the furrow cut by the disc, is a foot valve and spear of a similar type to that used in the Blundell Knapsack Injector. Connected to this through a small non-return valve, is the pipe which leads from the pump. Just behind the foot valve and attached to the main frame is another small disc which serves to cover

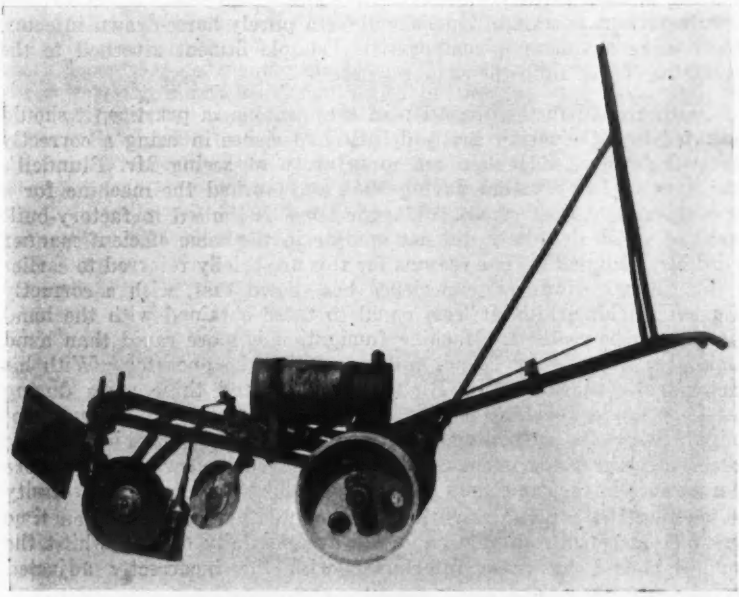

FIG. 4.—The Blundell mechanical fumigant injector.

the furrow cut by the larger disc. The whole of this assembly is set up so that the rear disc throws up a small mound of soil over the injection furrow cut by the front disc, whilst the left hand rear wheel follows along the same line and compresses the soil in the furrow. The depth of injection is controlled by raising or lowering the depth wheel at the forward end of the machine.

At the front end of the main frame, a rectangular steel plate is attached in such a manner that it serves to push any leaning cane sticks back out of the way so that they are not broken off by the passage of the machine through standing cane.

Either a horse or a narrow track, inter-row type of tractor may be used to pull the mechanical injector. Probably better results are obtained with a tractor, although with that type of traction two men are required to operate the injector, whilst using a quiet horse it is possible to carry

out the work with one man. One particular advantage of the tractor is that it pushes aside the trash so that it does not interfere with the operation of the machine. When the injector is horse-drawn, the writer found it an advantage, particularly in trashy cane, to fit a simple type of trash-lifter to the fore part of the machine so that the loose trash did not prove a source of trouble to the discs. When the machine is set up properly, with the main disc at the correct angle, trash causes little trouble to this portion of the machine. However, heavy trash does sometimes cause inefficient covering-in of the furrow, and as effective covering is most important it is believed that the trash lifter forms a most important portion of equipment for a purely horse-drawn injector. When using a tractor a comparatively simple fitment attached to the tractor itself will fulfil the same purpose.

With regard to the operation of the machine in practice, it should be stated that the writer has had little experience in using a correctly adjusted machine. He had an opportunity of seeing Mr. Blundell's own machine in operation during 1944 and worked the machine for a short distance. Most of his field experience is limited to factory-built machines which definitely did not operate in the same efficient manner as did Mr. Blundell's. The reasons for this are briefly referred to earlier in this paper. However, experience has shown that, with a correctly adjusted machine, kills at least equal to those obtained with the hand injector can be realised. Machine fumigation is more rapid than hand fumigation and the job is not unpleasant for the operator. With his tractor-drawn machine, Mr. Blundell has covered three acres during an 8-hour day. This was achieved in fairly long rows with consequent comparatively little turning. With a horse-drawn machine at the Northern Sugar Experiment Station, the area covered was a little more than an acre in the same time but the very short rows and the necessity for spelling the horse during the very hot weather of fumigation time were factors which militated against a greater daily output, whilst the troubles caused by trash interfering with the incorrectly adjusted machine further wasted a certain amount of time.

A further factor which operated against the efficient use of the machine during 1945 was the unfavourable weather. The heaviest rainfalls for many years were recorded in North Queensland during that year with the result that on the Northern Sugar Experiment Station, in the Cairns district, it was not possible to fumigate until April. Due to the good growing conditions experienced in spring and early summer followed by the heavy wet season, the cane on practically all blocks was much taller than desirable for fumigation by a horse machine and this resulted in a considerable slowing down of operations.

Nevertheless the fact that several acres were fumigated on the Northern Experiment Station with good results and under anything but ideal conditions indicates a very promising future for the mechanical injector. Whilst there will always be certain patches of lodged cane or cane in wet patches where a machine could not be used, it is confidently anticipated that, in many of the northern grub-infested areas, the mechanical injector will be responsible for the carrying out of the major portion of the fumigation campaigns.

The 1946 Burdekin Flood.

By W. J. S. SLOAN.

ALTHOUGH it is difficult to give accurate details of flood and cyclone damage, sufficient data are available to indicate that the aggregate losses suffered by cane farmers generally of the Lower Burdekin were less in 1946 than in the 1940 flood (see *Cane Growers' Quarterly Bulletin*, July, 1940, October, 1940, and July, 1941). The flood waters were higher in some places and lower in others, but the overall picture shows that the level was lower in 1946, although the water remained over the banks many hours longer. The warning stations up-river and the timely broadcasts concerning changes in the river levels were valuable in forewarning interested communities of the expected flood and no doubt made a vital contribution to the welfare of affected districts by avoiding loss of life and minimising property damage. However, the supply position in respect of building materials and replacements for lost or damaged equipment is very unsatisfactory and has added greatly to the difficulties of farmers endeavouring to restore their properties to working order again.

FIG. 5.—Severe erosion along headland extending into standing cane.

The most serious breaks in the river banks were chiefly those which figured in the 1940 flood. Damage to cane crops was not as great as initial estimates indicated but the decrease in sugar produced in the Lower Burdekin from direct and indirect effects of the flood and cyclone is predicted by local observers to be in the vicinity of 20 per cent. Cyclonic winds flattened much cane, particularly in early planted fields which had six feet or more of cane at the time, but there were few extensive areas of broken sticks, and fortunately, lodged cane later recovered very well. Because of the comparatively long immersion of the cane, some shooting of eyes and roots occurred and death of the growing point was caused by silting in some cases. Patches of cane in low lying and poorly drained areas died out completely.

Deposits of sand and silt to depths of up to eight feet were left both in standing cane and on fallow fields. Not all deposits were harmful and a few fields were enriched by a layer of fertile silt. Curiously enough, occasional fields which were seriously eroded in 1940 received a useful layer of silt this time. Scooping and levelling are expected to reclaim for profitable cane growing most of the areas affected by sand deposits.

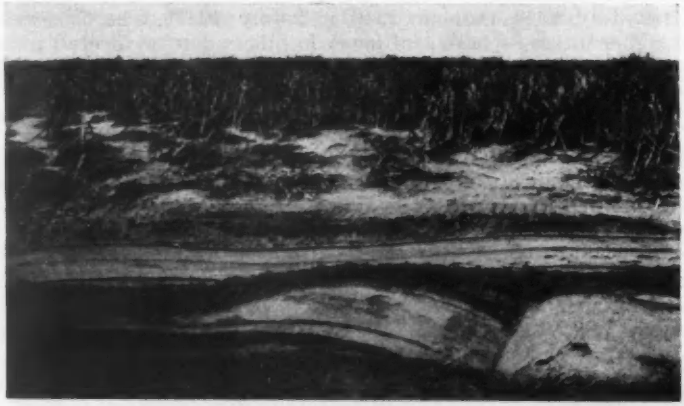

FIG. 6.—Cane partly buried by sand deposits. Scooping in progress on adjacent fallow field in foreground.

FIG. 7.—Heavy deposit of fertile silt on a fallow field.

The extent of sand deposits in standing cane cannot be accurately gauged but in many fields the indirect loss brought about by the blocking of irrigation furrows is considerable. Thus a large area will have to depend on natural rainfall until harvest and unfortunately droughty conditions followed the flood.

Many pumping plants were submerged and coated with silt; damage to these and overhead fluming was extensive. In several instances, the rise in the underground water level in wells temporarily put irrigation pumps out of action.

Flood effects are always more serious in furrow-irrigated areas, because levelling and grading are required to remake the fields suitable for irrigation. Following the 1940 Burdekin flood, certain recommendations were made and works carried out for the primary purpose of protecting the river banks and minimising the scouring effect of flood waters. Furthermore, a Burdekin River Trust was created. The duties of this authority were to maintain and carry out additions to protective works constructed along the river banks, in accordance with instructions from the Co-Ordinator-General of Public Works. It was also empowered to plant and maintain various species of soil-binding plants along the river bank.

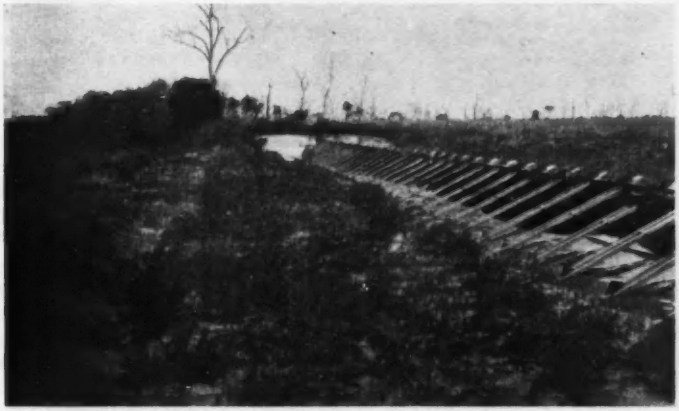

FIG. 8.—River side of a bulkhead showing dead Duranta and Clerodendron, which helped the depositions of silt.

Protective works which were constructed comprised timber bulkheads and earth levees, located at selected weak places in the river banks. The protection of the river bank by planting grasses, shrubs and trees to provide a dense vegetative cover over a strip one and a-half to two chains wide on each side of the river along 29 miles of the danger area, particularly around low portions of the river bank, was strongly recommended. The voluntary co-operation of farmers was sought, firstly in regard to ceasing the practice of cultivating to the edge of the river bank and secondly in recognising the need for not ploughing out any volunteer ratoon cane, until after mid-April, within five chains of the river bank reserve where such land was to be prepared for planting.

The object in constructing permanent bulkheads was to induce silting of the gullies at the low points adjacent to the river banks by checking the flow of flood waters. These were to serve primarily as a safeguard in times of high flood until such time as heavy vegetative cover had been established both in front of and behind the bulkhead

for prevention of any scouring. In the 1946 flood some of the bulkheads were destroyed while others completely withstood the flood. In any case the bulkheads all gave some relief and appeared to be effective except where a fresh break occurred at the end.

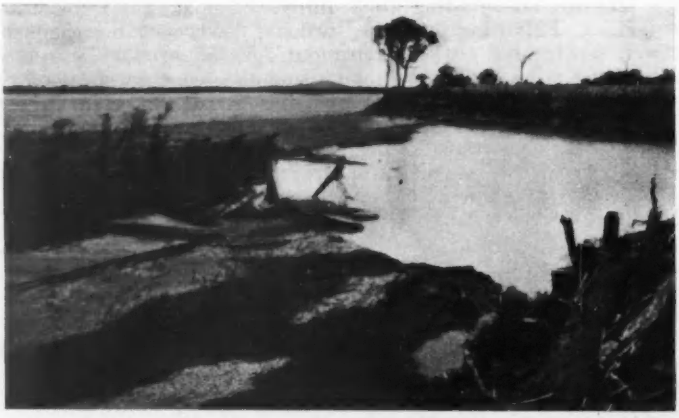

FIG. 9.—New erosion caused by a fresh break around the end of a bulkhead.

It has been suggested by local residents that trees and vegetation growing in the river bed impede the flood waters. Thus the rate of discharge of the river is checked, flood waters tend to build up and be diverted towards the banks while the sand deposits around the tree growth in the river are gradually raising portions of the river bed. Such being the case it is not unlikely that each high flood will form a series of new breaks in the river banks until such time as the latter are adequately protected with a dense cover of suitable vegetation.

A considerable amount of work has been done in planting and establishing soil binding plants along the river bank but much remains to be done. In the early phase of reconstruction work after the 1940 flood, *Duranta* hedge was planted freely but later was replaced by the shrub *Clerodendron* because of the superior drought resistance of the latter. Guinea grass was a satisfactory cover in places, but where the water flow was fast its shallow rooting system was torn out of the ground and the flood waters then commenced to scour a deeper hole where the plant had been. Giant bamboo which had been established only a few years exhibited a similar weakness. However, this plant when well established should be excellent for the purpose of slowing down flood waters and preventing excessive erosion of the banks.

The Trust intends to plant tamarind trees extensively, for they possess a good rooting system and stand up well to dry conditions. Among other trees for trial is black bean, which has given good results on the Haughton River at Giru. Para grass, a common fodder grass grown around swamps and along the banks of creeks in many parts of Queensland, has also shown promise for controlling stream bank

erosion, because it flattens on the ground and protects the soil as the water passes over it. Elephant grass, a vigorous, hardy, tall growing grass, may also prove to be valuable as a soil retaining plant.

Experience during the recent flood clearly showed that revegetation needs to be done thoroughly over a substantial area of the bank. In one instance natural plant cover over one chain between the bank and the edge of the cultivation was insufficient to prevent scouring in the latter. The tendency still shown by some farmers to disregard the warning not to cultivate right to the edge of the bank, is regrettable. In practically every case where a break occurred, ploughing in this manner was responsible. Unfortunately, in a number of these cases it was a neighbouring farmer who suffered the greater damage.

Although the 1946 flood occurred earlier than that in 1940, a large amount of land had been ploughed just prior to the flood and losses on some farms were heavy. Once again the retaining properties of a grass cover were plain to observe on the few areas which had not been ploughed. The inconvenience and perhaps loss of crop associated with late preparation and late planting are realised, but are unquestionably a small price to pay for the protection of cultivated land directly threatened by flood erosion which even if not disastrous, may prove costly to repair.

FIG. 10.—Deep hole in river end of cane field where flood waters broke through. Bank on right was held together by molasses seepage from a mill drain.

The flood of 1946 caused much soil erosion which could otherwise have been avoided had those concerned fully appreciated the precautionary measures required. Any project to combat soil erosion needs the wholehearted and sincere co-operation of all members of the community in the affected area, to achieve any considerable measure of success. One section alone cannot solve the problem. Negligence on the part of a small number of farmers situated along vital portions of the river bank may menace many.

*The Varietal Revolution in South Queensland.

By C. G. HUGHES.

SEVERAL times during the last few years there have been articles and short notes on the varietal changes occurring in the cane crops grown in South Queensland, but it is only lately that the extent of the change in varieties harvested has shown so obviously. Fig. 11, reproduced here, from the 1945 Annual Report of the Bureau of Sugar Experiment Stations shows it very clearly, and makes as spectacular a picture of a varietal revolution as could be found anywhere in the cane growing world.

In order to discuss the changes in the years 1933 to 1944, shown in the illustration, it is necessary to go back to before 1933. The figures for the two years 1921 and 1927 in the inter-war period give an indication of the general trend. Following the very poor 1920 season, the 1921 season was, at the time, very good in South Queensland, and over 300,000 tons of cane were harvested. Gumming disease had shown up in the drought of the previous year, but it had not reached the heights of destructiveness that it did by 1929. The old D.1135—"Fairymead" or "Frost Resister" to many an old-time farmer—had declined from a peak of 87 per cent. in 1917 to 68 per cent. of the crop; there were 11 per cent. of M.1900 Seedling, and small amounts of Badila and Q.813, whilst "others"—a very mixed lot—made up 19 per cent. of the total. By 1927, the outbreak of gumming disease was well advanced, but there were still many susceptible varieties grown. The percentage of D.1135 had dropped to 42, but there was 19 per cent. of M.1900 Seedling; Badila had risen to 3·5 per cent. and, most importantly as showing the hunt for gum-resistant canes by the farmers, Q.813 now comprised 10 per cent. of the crop. Other varieties had increased to 26 per cent.

The testing of many new and old varieties in order to find a satisfactory cane resistant to gumming went on continuously, and by 1933 there was a large array of canes fairly well represented in the tonnages harvested. There were eleven varieties represented in substantial amounts and many others in smaller quantities. D.1135 was still prominent, and formed over one-fifth of the crop, but gum-resistant canes now comprised over 40 per cent. of the tonnage milled. It was obvious, however, that farmers were still anxious to have a gum-resistant cane with better milling qualities than Uba (there was later a ten shillings per ton penalty on this cane) and more vigorous than Q.813; they also wanted a cane that could be stood over should the necessity arise. Looking back over the experience of the last dozen years, it can be seen that the really significant event of the 1933 crushing was the appearance of about 1 per cent. of the new cane, P.O.J.2878. P.O.J.213, also mentioned, was destined to become important for a while, and then to fade out. Co.290 had to wait till the next year, 1934, to make an appearance.

It was not by pure chance that P.O.J.213, P.O.J.2878, and Co.290 came to South Queensland to combat the gum and give high yields just when new canes were so badly needed. The Bureau had initiated a large-scale importing and testing programme when the threat from gumming became serious, and over one hundred varieties had been brought into the State from all over the world. The three mentioned soon showed their disease resistance and yielding capacity, and were

* Paper presented at the Bundaberg Conference, Q.S.S.C.T., April 1946.

propagated rapidly. It may be of general interest to digress here a little and recount the origin of these canes. P.O.J.213 is the oldest of the three, and came from a cross made in Java in 1899; its parents were Black Cheribon and a thin Indian cane called "Chunnee." P.O.J.2878 was also bred at the Experiment Station in Java (hence "Java" or

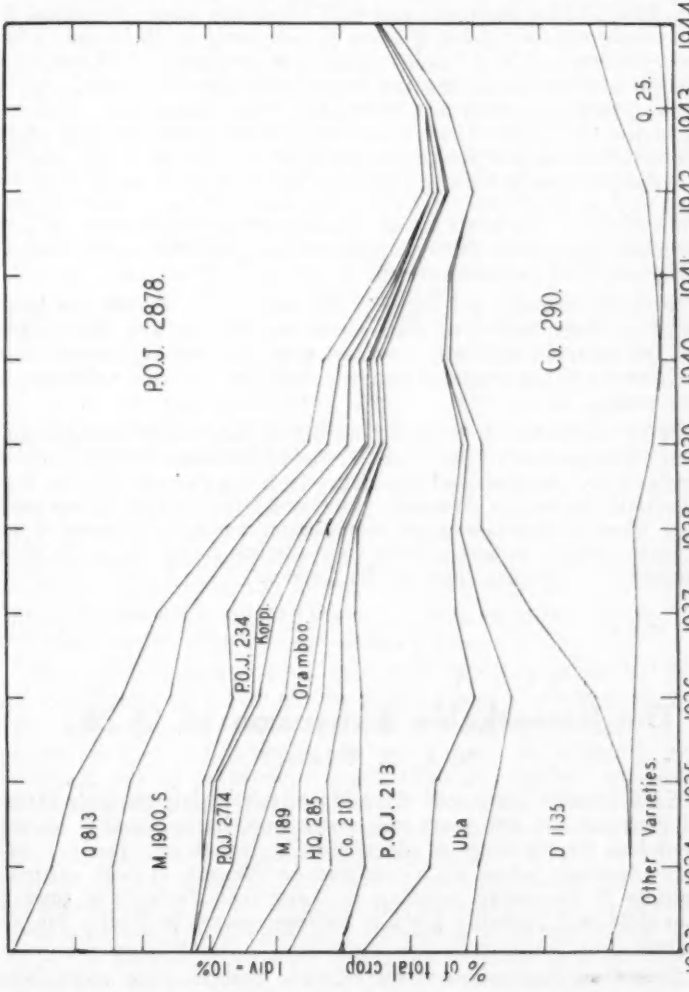

FIG. 11.—Graph illustrating the percentages of varieties harvested in Southern Queensland, 1933-1944.

"Java Wonder" as synonyms), and came from P.O.J.2364, a special breeding cane of no commercial value, and the well-known E.K.28. The cross between P.O.J.2364 and E.K.28 was made in 1921 and the selection made the following year. By 1928 seedling number 2878 had earned its P.O.J. number, and was showing very prominently in trials. The

Bureau imported it into Queensland that year, and as it showed promise from the start, it was multiplied rapidly. The third cane, Co.290, was bred at Coimbatore, the Sugar Experiment Station in British India, and has P.O.J.213 as one parent and a locally raised seedling as the other.

To get back to the consideration of our diagram. There were many old canes represented in the mixture of varieties harvested in 1933, and D.1135, Uba, M.1900 Seedling, and Q.813 were the major varieties, the four of them together forming over 60 per cent. of the crop. Over the next few years, P.O.J.213 increased to a maximum of 17 per cent. in 1936 but practically all the other canes featured in 1933 faded rapidly away. The writing was already on the wall with the increase of P.O.J. 2878 and Co. 290. Then came a virtual flooding in of these new canes and the old showed practically only as lines to extinction. P.O.J.2878 had a rapid steady increase to a peak of over 60 per cent. in 1942—it has dropped back a little since. Co.290 went from nothing to about 30 per cent. in six years and has remained stationary at that figure. A new Bureau cane, Q.25, made its first appearance at the mills in 1940 and by 1944 comprised 10 per cent. of the crop.

The varietal change is complete. The miscellany of 1933 has given way to three main varieties, with all others making less than 5 per cent. of the total. In addition, these new canes have brought a new level of production, and a season by season stability of yield unknown in previous years.

Talk of varieties will set many an old farmer recalling canes and yields of "the good old days," even back to Cheribon, Otamite, Yellow Caledonia, Rose Bamboo, and the like. It is a sobering thought that a generation hence the Wonder Cane and its contemporaries will probably likewise be subjects for sentimental musings, superseded by newer canes which are just a little more disease resistant, just a little more adapted to the conditions of the district.

The Remarkable Expansion of Q. 28.

BY C. G. HUGHES.

MACKAY farmers know well the value of this variety on their farms during the last few years but, apart from its appearance on the approved list for planting at Maryborough, it has not received the publicity elsewhere which its performances warrant. It will surprise most people in the sugar industry to learn that during the coming crushing Q.28 will probably yield a tonnage second to Badila for all Queensland.

Q.28 is a seedling raised at our Mackay Station. The cross from which the original seed came was made in 1935 when the pollen from flowers of Q.1098 (a cane raised in the early years of this century but never very important commercially) fertilised those of Co.290. The ripened seeds were sent to the Mackay Experiment Station for germination. Fewer than 50 seedlings of this cross germinated but at selection time in 1936 it was obvious that one at least would have to be chosen for

further testing. This cane, which later became Q.28, did very well in these trials and was planted out on two farms in the Mackay district in 1939. Further propagation and trials followed and results were published in the January, 1942, issue of the Canegrowers' Quarterly. A summary of these figures shows that over the five plant crop trials Q.28 averaged 31·6 tons of cane per acre at 15·1 C.C.S., giving 4·77 tons of sugar per acre; at the same time, the standard canes, Q.813, E.K.28, M.1900S. and S.J.2, planted in the trials for comparison, averaged 20·89 tons at 15·77 giving 3.29 tons of sugar per acre. Yield figures from the ratoons of the same trials were even more in favour of Q.28, which averaged 24 tons per acre of cane and tested 15·5, giving 3·72 tons of sugar per acre, whilst the established commercial canes yielded only 10·3 tons per acre at 15·85 C.C.S. to return 1·63 tons of sugar. In the ratoons, the dry summer conditions of 1941-42 had been followed by an open winter and Q.28 had thrived better under these conditions than the other canes.

The phenomenal growth of this new cane quickly established its reputation, and many farmers made large scale plantings. It was put on the approved list for the Mackay and Plane Creek mills in 1942 and since then has gone ahead rapidly. In 1942 the mills did not crush any Q.28—it was all planted; in 1943, 2,409 tons were milled; 1944 saw 111,000 tons through the rollers and the variety had become the fourth most popular cane in the Mackay district on tonnage harvested. Last year the 292,900 tons crushed put Q.28 in first place at Mackay and in fifth place for the State as a whole. It is expected that well over 400,000 tons will be harvested this year. This is surely a remarkable record for a variety which in 1936 consisted of a single stool. The very poor season in South Queensland will cut down the tonnages of P.O.J.2878 and Co.290, and Trojan (fourth in 1945) has very nearly reached saturation point at Ingham, whilst its propagation in other areas has not yet advanced sufficiently to yield large tonnages this year. Thus it is probable that Q.28 will be second to Badila when the figures for the 1946 crushing are released.

As may be gathered from its parentage, Q.28 is not a "noble" cane, like Badila or B.208, but has a number of characteristics similar to the female parent, Co.290, although it is slightly thicker. It is an excellent striker and ratooner and even heavy crops usually remain upright. It covers in fairly rapidly although possibly not quite so quickly as Co.290 and is fairly drought resistant. Q.28 is capable of splendid growth during the cooler weather providing the winter remains open, and this characteristic enabled the Mackay district to produce a fair crop last year when the summer wet season practically failed. From the disease point of view the variety is quite satisfactory; it is resistant to gumming and Fiji diseases and moderately so to mosaic and downy mildew. A shallow root system makes it susceptible to grub attacks at Mackay but the hard rind is unattractive to beetle borers. Like other late maturers which may grow through the winter, its sugar in the early part of the season is usually comparatively low.

Q.28 is not offered as a world-beater, but as a hardy, vigorous cane. Although late maturing, it will certainly have a place in those districts where the thinner types of cane are grown.

C.P. 29/116 and Q. 49 in South Queensland.

By NORMAN J. KING.

ONE result of the acute field staff shortage, brought about by wartime conditions, was the curtailment of farm trials with new varieties. Promising seedling canes bred just prior to or during the war years and varietal introductions have therefore been evaluated in weighed trials on the Experiment Station only, and subsequent distribution was based on observational trials on a number of soil types, without formal confirmatory trials. In Bundaberg and some of the other South Queensland districts four new varieties have been distributed during the war years, and many growers are unfamiliar with the histories and characteristics of these canes. Of these four varieties C.P.29/116 and Q.49 appear to be the most useful and it is hoped that the following notes will assist growers in planning their future plantings.

C.P.29/116.—This variety was imported by the Bureau from Canal Point in Florida (U.S.A.), whence come the initials C.P.; it was bred there in 1929. The variety came to Queensland with a reputation for frost resistance in Louisiana, but it should be kept in mind that this term does not necessarily mean the same here as there. In Louisiana standing canes are killed by the freezes which occur during most harvesting seasons, and a variety is termed frost resistant if it will retain its sugar content for a reasonable period after being killed. In South Queensland frost resistance infers that the variety will resist the comparatively low temperatures experienced and will not be killed. C.P.29/116, however, will not resist a heavy frost in the sense in which we use the term here. Based on observations in Bundaberg, it is considered slightly more resistant than P.O.J.2878 of equal height. Since frost damage decreases with height of cane, and as under most conditions C.P.29/116 is taller than P.O.J.2878 of the same age, it can be accepted that it is less liable to frosting than is P.O.J.2878. However, it may be quite badly damaged by severe frosts and cases have been observed where the growing point and several of the top buds have been killed. Such cases are a severe loss because in June and July C.P.29/116 has only a very low sugar content and cane with a dead growing point cannot be expected to increase much in C.C.S. value. The low sugar content of this variety in the early part of the season is likely to cause much disappointment among growers. The Bureau has issued warnings several times on this feature of C.P.29/116, and has advised all farmers not to make excessive plantings until much more experience is gained with it. At the present juncture it is suggested that no grower should contemplate having more than 30 per cent. of his gross assigned acreage under this variety. A single good season will produce crops well over the peaks; this would mean an early commencement of crushing with consequent very low C.C.S. for the growers who had nothing but C.P.29/116 to cut in the first two months.

The other characteristics of C.P.29/116 are very favourable. Everyone now knows of its excellent striking and ratooning abilities, its good stooling, its ease of working, and its performance on poor lands. It is resistant to gumming, mosaic, and downy mildew, and it is not nearly so susceptible to Fiji disease as the varieties P.O.J.2878 and Q.25. Not so well known perhaps is the fact that it stands over very well if it has not arrowed. These good features of C.P.29/116 are responsible for its

current widespread planting and no doubt the grower may be satisfied to sacrifice some C.C.S. while doing away with the expense of supplying "misses" and minimising the incidence of disease. It is for each individual to calculate just how much of this cane he can afford to grow, but at the moment the best advice is to hasten slowly.

Q.49.—Another variety of promise, Q.49, was bred on the Bundaberg Station in 1938. It is a seedling cane obtained by crossing P.O.J.2878 with Co.290, two parents which have been proved to carry most of the characters desirable in a South Queensland variety. However, neither parent is the ideal variety for all districts of South Queensland; Co.290 will not stand over satisfactorily, has a rather low sugar content, and

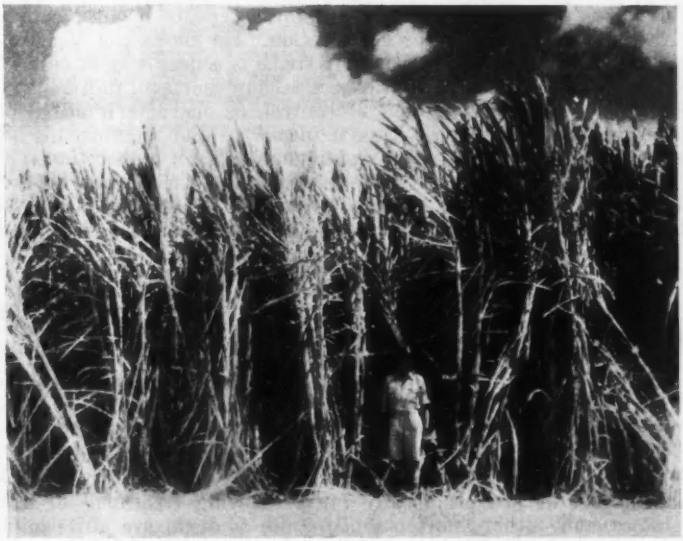

FIG. 12.—A crop of 17 months' old Q.49 which averaged 84 tons cane per acre on an irrigated farm in the Gooburrum district.

may give faulty strikes and ratoons on occasions. P.O.J.2878 has the undesirable feature of susceptibility to both Fiji and downy mildew diseases. In Q.49 the good features of both parents appear to have been combined; the variety has a good barrel, with the internodes slightly staggered; it has an upright, compact stool with good top cover, only slight hair growth, and has quite good vigour. It is satisfactory either as a one year or standover variety and has already proved to be an excellent striker and ratooner under a wide variety of soils and conditions. It is resistant to gumming, Fiji and downy mildew diseases. Although several hundred acres are now growing in the Bundaberg area, no Fiji disease and only twenty stools of downy mildew have so far been recorded. A couple of stools infected with mosaic have been observed in the Moreton area. Sugar figures to date have been obtained only on Experiment Station plantings and these have been satisfactory and compare well with P.O.J.2878. Much more experience is needed yet before its general C.C.S. content can be assessed.

It is interesting to record that a planting of this variety was made on an irrigated farm in the Gooburrum district in September 1944 to observe how it would perform under irrigation as a standover variety. Part of the block was cut for plants in February 1946 when the cane was 17 months old, and this averaged 84 tons per acre. The photograph (Fig. 12), taken in February, shows the remainder of the crop at that time. Maturity tests will be made on this crop from June of this year.

A Chemical Aid to Germination.

The cane farmer is always concerned with the threat of bad strikes and as far as possible takes all precautions to ensure that the cane setts receive the best conditions for germination. He knows the expense and labour involved in supplying a patchy strike is a dead-weight cost which is very desirable to avoid. However, a labour shortage, untimely rains, a tractor break-down, a fire out of control, or one of a hundred other happenings on the farm may force a farmer to plant against his better judgment, and the setts go in under unsatisfactory conditions. The soil may be too wet or too dry or too cold, but the farmer hopes "to get away with it" and obtain a good strike. It is obvious that anything that will help the cane buds withstand adverse conditions will make a big difference to the ultimate stand of cane.

A delicate balance exists in the soil between the cane buds on the one hand, and the soil fungi seeking to rot the sett on the other, and when conditions are adverse for the buds the fungi triumph and the sett rots. Fungi are, of course, susceptible to various poisons and antiseptics, but only within recent years has it been considered feasible to try to protect the cane sett with an antiseptic or "fungicide." Experiments which have been carried out both in Queensland and South Africa make it clear that certain compounds containing mercury are the most suitable for the purpose. There are many mercurial preparations on the market at present, mostly for pre-sowing treatment of grains or potatoes, and, although often sold for use as dusts, are quite suitable for use in solution. There are indications that the effectiveness of a particular brand may vary with the conditions, and one which stimulates germination in wet soil, for instance, may not do so under dry conditions. The treatment is to soak the cane plants in a solution of the mercury compound overnight if possible, but if that cannot be managed then the strength of the solution is increased and the soaking time reduced.

Treating cane setts with mercury compounds is becoming well established in South Africa, where conditions are often very harsh at planting time, but owing to wartime shortage of supplies investigations in Queensland are still largely in the experimental stage. Preliminary experience shows that the practice can be very effective, but details of the best preparation to use under different sets of conditions have not yet been finalised. A range of farm experiments is being planted this winter and early spring in several of the sugar growing areas.

Any farmer who desires to do some experimenting on his own can obtain further details by communicating with the Bureau either in Brisbane or through the nearest field officer.

C.G.H.

*Post-War Fertilizing.

By NORMAN J. KING.

Introduction.

THE shortage of fertilizers for the sugar producing areas of the State—brought about by war—has undoubtedly had a marked effect on cane production. Complicated, however, by other factors, the principal of which was the deficiency of man-power, it is not possible to measure with any degree of accuracy the decrease in production caused by fertilizer rationing *per se*. All sugar growing areas suffered in some degree, but the effect was more marked in some areas than others. Growers in some of the fertile alluvial districts were not affected by phosphate and potash rationing, and nitrogen supplies were kept at a reasonable level for ratoon crops for most of the war period. Similarly the recognised potash deficient soils of the various districts were allotted practically all of the available potash supply and the production on these soils did not seriously suffer during the war. The supply shortage was probably felt most seriously on the average sugar lands of the State—lands which in normal times grew fair to good crops with moderate fertilizer applications.

South Kalkie District.

As an example of the manner in which production dropped badly in just such an area it is of interest to examine the record of the South Kalkie section of the Millaquin mill area. This part of the district was selected for study nearly two years ago because of the very obvious decrease in yield per acre. Perhaps in no other sugar producing part of the State could it be said that production was less affected by labour shortage. South Kalkie is a remarkably uniform and closely settled area—an area of relatively small growers who harvest annually about 500 tons of cane each. Labour difficulties did not affect the grower of this size to the same extent as it did the larger producer. Added to this is the fact that a good proportion of the South Kalkie farms are irrigated. It is a reasonable assumption therefore that—allowing for the variability of seasons—crop variations are mainly the result of fertilizer shortage.

It should be made clear, in the first place, that this district consists of fine sandy loams, which, even in the virgin state, are phosphate deficient and of only average potash content. In pre-war times the usual fertilizer used was one fairly rich in phosphate and of medium potash content. Fertilizer trials showed little response to potash, but good returns from phosphates and nitrogen. The fertility level of the soil was such that these mixtures were sufficient to supply the requirements of good crops, but later experience indicates that the crop was probably taking from the soil just about all the potash which was there to take. In other words the soil nutrients were being kept at just above a critical state and any factor which tended to upset this critical balance would have an immediate effect on crop production. The rationing of potash was such a factor.

* Paper presented at the Bundaberg Conference, Q.S.S.C.T., April 1946.

Production Record.

When, in 1940, partial rationing was introduced, limiting mixtures to a maximum of 15 per cent. potash, the South Kalkie area would not be affected, and this is borne out by the production of the area in 1941. In 1942 the fertilizer position had become serious and a general rationing scheme was introduced whereby every individual grower was limited in his fertilizer purchases. The potash was in particularly short supply and it was deemed advisable to issue this ingredient only to growers on such soil types as were known to be particularly potash deficient. This decision automatically cut South Kalkie off from potassic fertilizers. The effect was to be looked for in the 1943 and 1944 crops. As a unit the South Kalkie area supplies almost one-fifth of the Millaquin cane supply and is thus a sufficiently large sub-district upon which to base comparisons with the remainder of the Millaquin mill area.

The years 1938 to 1942 inclusive give a good cross section of average production unaffected by potash rationing and not complicated by any serious variety change. Seasonal variation would be the major factor in any crop alteration. The following two years, 1943 and 1944, are the only two available for comparison as representing crops grown without potash. The following table shows the tons of cane harvested,

Year.	Tons Cane Harvested.		Acreage Harvested.		Tons Per Acre.	
	South Kalkie.	Rest.	South Kalkie.	Rest.	South Kalkie.	Rest.
1938	29,444	128,955	1,099	5,200	26·8	25·1
1939	35,220	155,977	1,235	6,174	28·5	25·8
1940	37,345	153,607	1,327	6,462	28·1	24·5
1941	25,490	115,733	1,019	4,949	25·0	23·6
1942	22,655	113,380	1,192	5,588	19·0	20·1
1943	17,959	97,181	1,163	5,570	15·4	17·1
1944	27,994	131,331	1,230	5,866	22·7	22·5

the acreage harvested, and the average tonnage per acre for the South Kalkie area and for the remainder of the Millaquin area during the years 1938 to 1944.

These figures are shown graphically in Fig. 13. It is clear that the acreage harvested in South Kalkie remains a fairly constant percentage of the total district acreage harvested varying only from 16·7 per cent. in 1939 to 17·6 per cent. in 1942. But the tonnage per acre dropped from 28·5 in 1939 to 15·4 in 1943, while for the same years the rest of the Millaquin area dropped from 25·8 to 17·1. These drops represent 13·1 and 8·7 tons per acre respectively. If seasons were responsible in the main for production decreases then it would be expected that the South Kalkie area would show a smaller drop than the rest of Millaquin by reason of the greater proportion of irrigated cane in that section. But since the decrease in tonnage per acre is so much greater in South Kalkie the inference is that potash rationing was the major contributory factor.

The figures for total tons of cane harvested show that the decrease was much more pronounced in South Kalkie than elsewhere, particularly in the 1943 season, the year after potash was withdrawn from the area. The figures for 1944 are not easily explained. Production increased in

this year in all parts of the Millaquin area, but the increase was greater in South Kalkie. Possibly the explanation is that, despite potash deficiency, closer attention to irrigation practice, and perhaps a greater

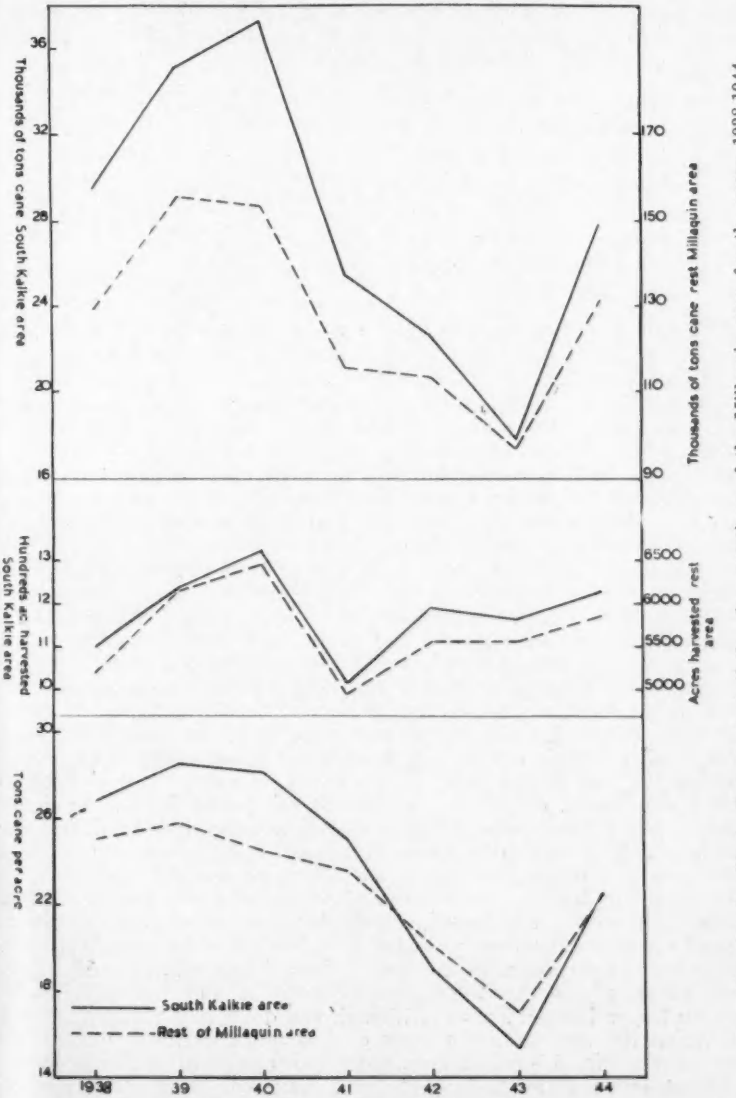

FIG. 13.—Graphs illustrating crop statistics for portions of the Millaquin area for the years 1938-1944.

proportion of plant cane, were the causes. Reference to annual production figures for the individual farms in South Kalkie bears out the irrigation suggestion. Much greater production increases are shown on the irrigated farms than on the dry ones for the 1944 period.

Soil Fertility Survey.

The soil fertility survey which was inaugurated in the South Kalkie area in 1944 brought to light some remarkable facts. The analysed soils were taken from 61 farms representing 2,308 acres of cultivated farm land. Actually the acreage of the blocks sampled was 622, and analysis of the soils showed the following facts:—

Total acres sampled	622
Acres requiring lime	520
Acres low in phosphoric acid	262
Acres medium in phosphoric acid	285
Acres high in phosphoric acid	75
Acres low in potash	508
Acres medium in potash	83
Acres high in potash	31

These are extraordinary figures for a fertility survey on what is considered good sugar land. This cannot all be explained away by fertilizer rationing. It was stated before that these soils, even in the virgin state, are phosphate deficient; so much so that in one case several years ago where land was just cleared it was found impossible to grow even a plant crop of cane until superphosphate was applied. In this case the soil contained only six parts per million of available phosphate. The soils are, in the virgin state, reasonably well supplied with potash, and so long as a fertilizer containing about 8 per cent. of potash is regularly applied there will be no potash deficiency. But if the land is called upon to produce good cane crops without potash—as happened during some of the war years—the results are very soon made evident in lowered production. The problem arises as to what fertilizers should be used on these soils in post-war years when unrestricted fertilizer supplies are available. All growers in this area were advised individually of the results of their soil analysis and recommendations were made as to what mixture to use in normal times. All growers must continue to use fertilizers with a good content of phosphoric acid. Where the potash is low in soils analysed it is advisable to use Sugar Bureau No. 2 mixture which contains 12·5 per cent. of phosphoric acid and 14·5 per cent. of potash. Where the soil potash is medium Sugar Bureau No. 1 mixture is recommended containing 16·5 of phosphoric acid and 7·25 per cent. of potash. These are the figures for the planting mixtures; the corresponding ratoon mixtures contain rather lower percentages of the two ingredients. The mixtures are always used in conjunction with a top-dressing of sulphate of ammonia except where a good green manure crop preceded the planting of the cane. In such cases only the ratoons are top-dressed with sulphate of ammonia. Very few, if any, of the South Kalkie soils need the high potash mixtures such as Sugar Bureau No. 3. Although run down as a result of potash starvation the recuperative powers of this soil type are rapid. Four cwt. of the No. 1 or No. 2 mixture per acre will suffice to grow excellent crops if applied wisely and followed by the sulphate of ammonia. The use of straight potash is not advised now that mixtures are available. Even when very potash deficient these soils require only moderate amounts of potash. Four cwt. of No. 2 mixture contains 108 lb. of straight potash. It is not practicable to spread 108 lb. over an acre unless mixed with something else. Consequently where straight

potash is used it is either applied too heavily and thus wasted or the grower has to laboriously mix the potash with some other ingredient for practicable distribution.

Conclusion.

The question of post-war fertilizer practice will arise in many parts of the coastal sugar belt within the next couple of years. It is only natural that the disturbance caused by rationing will upset the soil nutrient balance in many of our average and poorer quality soils. The growing of crops for several years without potash and with limited amounts of phosphates must cause depletion of soil reserves and it is probable that the majority of growers will need to expend larger amounts on fertilizer for the next few years to bring the farms back to their pre-war state of fertility. Already some fertilizer trials have been laid down with the object of finding out the correct levels of fertilizer required to promote optimum growth of crops.

Fertilizer Supplies.

By L. G. VALLANCE.

THE rationing of fertilizer for use in the sugar cane industry is now in its fifth year of operation. Unfortunately the cessation of hostilities in 1945 brought no immediate prospect of sufficient supplies being available for the discontinuance of rationing. However, since the disastrous year of 1942 in which approximately only one quarter of normal requirements was obtained there has been a steady increase in supplies and substantial, though still insufficient, amounts are now available to growers for the rationing year 1945-46.

As early as 1940 it was obvious to those closely associated with the industry that some scheme to provide equitable distribution of fertilizer would become necessary. The sudden drop in potash imports made it necessary to impose a partial restriction in that year. From then on the position deteriorated rapidly and with the loss of the Nauru supplies the phosphoric acid shortage also became acute. Early in 1942 the Bureau of Sugar Experiment Stations was allotted the unwelcome task of instituting some form of rationing to ensure that each sugar grower received not only his fair share of available supplies, but also the most suitable fertilizer for his particular requirements. The latter aspect was undoubtedly the most difficult obstacle in designing a workable scheme.

Fortunately, however, many years' experimentation with fertilizer in field trials had made it possible to assess with considerable accuracy the fertilizer requirements of all the major soil types used for the production of sugar cane. The local knowledge of field officers, together with that of many growers' organisations throughout various districts, was utilised to classify each individual farm according to its soil type or types. Each grower was then allotted a basic quantity of nitrogen, phosphoric acid and potash which would be sufficient to fertilize his farm efficiently and economically. The relation of the number of basic units allotted to him in this way to the total number available to the industry as a whole determined the amount of fertilizer the farmer

was ultimately able to purchase. With slight adjustments in the classification of minor soil types this scheme has proved itself to be a practical and equitable method of apportioning the fertilizer allotted to the industry.

A major difficulty in the actual distribution of allotted fertilizer is that imposed by inadequate transport facilities. Unfortunately, in very many cases the late arrival of supplies has made it impossible for the grower to utilise his restricted allotment in the most efficient manner. In the early days of rationing a further drawback was the inability of the fertilizer companies to manufacture mixtures. This was caused by the uncertainty and irregularity of supply as well as by lack of transport and manpower. The grower had, perforce, to take his ration as "straights" and make his own mixtures, which added considerably to his own labour problems. As soon as it was possible, therefore, the marketing of mixtures was resumed and every effort has been made to adjust the ingredients so as to conform with the mixtures previously found most suitable in pre-rationing days. However, because of the alterations in the composition of some of the materials, notably meatworks and superphosphate, and of the shortage of supply of others, it is not yet possible to manufacture the six original recommended Sugar Bureau mixtures. These, it will be recalled, were as follows:—

—	Nitrogen, Per Cent.	Phosphoric Acid, Per Cent.	Potash, Per Cent.
No. 1 Planting Mixture	1·0	17·0	7·5
No. 2 Planting Mixture	1·25	12·75	15·0
No. 3 Planting Mixture	1·75	10·0	25·0
No. 1 Ratooning Mixture	4·25	13·0	6·25
No. 2 Ratooning Mixture	4·25	10·75	12·5
No. 3 Ratooning Mixture	4·5	6·5	22·5

These mixtures have been found, by actual field experimentation, to conform to the requirements of the majority of cane growing soils of Queensland. For comparison, the mixtures which are available for the second half of the fertilizer rationing year (January-June, 1946) are quoted:—

—	Nitrogen, Per Cent.	Phosphoric Acid, Per Cent.	Potash, Per Cent.
No. 1 Mixtures	1·5	16·25	6
No. 2 Mixtures	4·5	13·25	6
No. 3 Mixtures	4·0	9·25	20
No. 4 Mixtures (Burdekin only)	6·0	13·5	Nil

It will be seen that although No. 1 mixture is reasonably similar to the original No. 1 Planting Mixture, there is no provision for a No. 1 Ratooning Mixture, which contains the extra nitrogen so highly desirable for ratoon crops. To overcome this a grower who has been allotted No. 1 Mixture in his ration is given the opportunity of taking No. 2

but it must be pointed out that, in so doing, he will lose phosphoric acid although he gains nitrogen. Nos. 2 and 3 Mixtures also contain much less potash than the original Nos. 2 and 3 Planting and Ratooning Mixtures. However, in spite of the deficiencies apparent in the above rationing mixtures there is no doubt that their intelligent use will be of considerable value to the industry. In addition to the fact that fertilizer may now be purchased in the form of these quite useful mixtures, it is gratifying to note that the total amount of fertilizer allocated to sugar for the year ending June, 1946, has shown a substantial increase over that of any year since 1942. The Bureau is pressing for a further considerable increase for 1946-47 and every effort is being made to raise the sugar industry quota to the amount used in 1939-40 at least, which is the maximum yet utilised by the industry.

The necessity for the provision of ample supplies of fertilizer to maintain production is strikingly revealed by the figures given below. This table and the accompanying diagram (Fig. 14) are reproduced from the annual report of the Bureau for 1945.

RELATION OF PRODUCTION TO AREA HARVESTED AND FERTILIZER SALES FOR THE YEARS 1936–1945.

Season.	Tons Sugar Made.	Acres Harvested.	Tons Sugar Per Acre.	†Tons Fertilizer.
1936	744,261	245,152	3·04	45,000
1937	763,325	249,683	3·06	50,000
1938	778,136	251,064	3·10	56,000
1939	891,422	261,047	3·41	61,000
1940	759,446	265,738	2·86	59,000
1941	697,345	246,939	2·82	54,000
1942	605,680	238,213	2·54	35,000
1943	486,447	228,895	2·125	15,000
1944	643,540	222,215	2·90	29,000
1945	*635,000	*242,000	..	32,000
1946	*625,000	*246,000	..	39,000

* Estimate.

†Approximate sales for previous year ; the effect of fertilizer is seen in the crop harvested the year following its purchase and application.

The figures in the last column of the table represent the approximate sales of fertilizer sold the year previous to the corresponding tonnage of sugar. It is evident that the amount of fertilizer has definitely affected the crop harvested the year following its purchase and application. This is also clearly shown diagrammatically in Fig. 14 where the line which represents the yield of sugar drops sharply as the line representing the application of fertilizer falls; at the same time the line denoting the area harvested remains fairly level. Admittedly other restrictions also operated during the war years to cause decreased production, but there is no doubt that the poor supply of plant food and the delays in application caused by transport difficulties were major factors.

The fact that scarcity of supplies has emphasised the value of fertilizer throughout Queensland is poor consolation for the individual grower who has had his livelihood so drastically affected. It is also true that with sugar cane, which is not an annual plant, the effect of plant

food shortage is likely to persist for some time as the success of the succeeding ratoons depends to a large extent on the vigour of growth of the plant and previous ratoon crops.

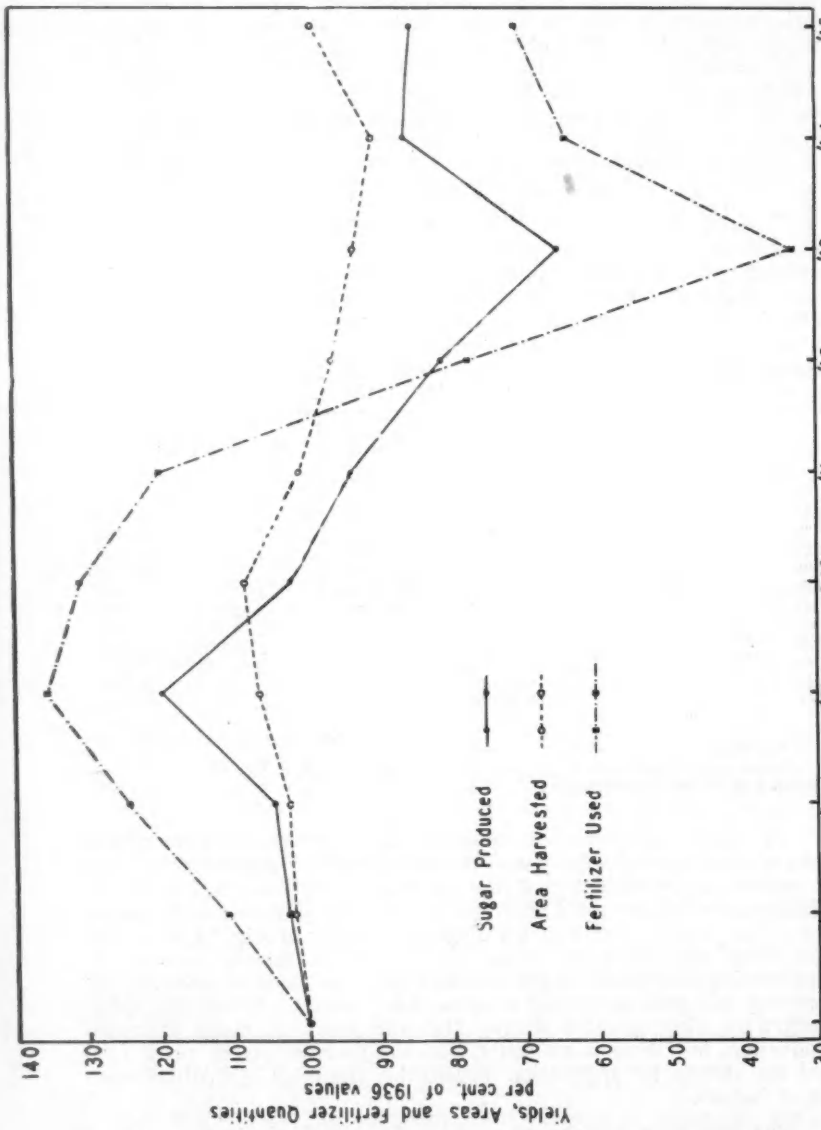

FIG. 14.—The relation of fertilizer applied and acres harvested, to the production of sugar in Queensland over the period 1936-45.

Unfortunately, at the time of writing rationing is still with us. The fertilizer shortage and urgent need for increased food production is world wide. Australia depends to a very large extent on overseas

imports for the manufacture of fertilizing materials. In addition recent internal industrial troubles and the ever-present transport problem may materially affect local production, particularly of phosphatic fertilizers.

However, just prior to going to press a meeting of representatives of the various State Departments of Agriculture was held in Melbourne to discuss fertilizer allocations for 1946-47. This was attended by the writer on behalf of the sugar industry with the result that the quotas of sulphate of ammonia and superphosphate allotted to Queensland may be regarded as being generally satisfactory. Because of the lack of definite information from overseas regarding the supply of potash, it is not yet possible to predict to what extent this essential material will be available. The Bureau has repeatedly stressed the necessity for considerably increased allocations of potash for sugar and every effort is being made to ensure that growers will receive their fertilizer in the form of mixtures most suitable for their requirements.

Fig. 14.—The relation of fertilizer applied and acres harvested, to the production of sugar in Queensland over the period 1936-45.

Downy Mildew Diseased Fields in the Woongarra District.

Downy mildew disease has been a problem in the Woongarra district ever since the susceptible P.O.J.2878 has been grown on a large scale. During the past few years roguing gangs of the Bundaberg Cane Pest and Disease Control Board have systematically dug out all diseased stools found and a good measure of control has been obtained. This summer, however, weather conditions have brought about a sudden serious increase in the amount of disease.

Downy mildew is essentially a disease of young cane in that the crop is most susceptible when young and growing rapidly; the disease itself is favoured by warm moist weather and should these conditions hold at a time when there is much young cane, the stage is set for a rapid increase in infection. Last spring and early summer were droughty in the Woongarra, so much so that even in late February there were many blocks which had made no cane. Then a partial wet season intervened, and a severe local hailstorm in March killed many tops and subsequently much sideshooting developed. The net result was that nearly every field in the Woongarra was forced into rapid growth at the same time, and with the warm steamy weather prevailing, conditions were ideal for the spread of downy mildew.

The outbreak is serious and strong measures will be necessary if it is to be controlled. The roguing gangs have been concentrated in the diseased area, but it is obvious that irrespective of the state of an individual field, heavily diseased crops cannot be allowed to standover or be ratooned further without running a grave risk of the disease getting out of control and so causing the loss of the valuable P.O.J.2878. The purpose of this note is to draw attention to the position in the Woongarra so that farmers will realise what action may have to be taken with regard to their diseased fields and so plan their programmes accordingly.

C.G.H.

Dwarf Disease in the Mackay District.

BY W. A. MCDOUGALL.

DWARF disease was first brought to the notice of Bureau officers in 1930 when it was found in the Mackay district, although there are good reasons for believing that it had existed there for many years previously in the localities now known as the "dwarf area." This area covers the part of the parish of Howard south of the Mackay-Walkerston road, the eastern portion of the parish of Greenmount, and all the parish of Chelona.

The initial discovery of dwarf disease was in the variety P.O.J.2714, and the disease has since been found in P.O.J.2878, P.O.J.213, E.K.28, H.Q.426, Q.45, Q.20, Comus and the now discarded variety Malagache. Dwarf disease can be very destructive in the highly susceptible varieties P.O.J.2714 and P.O.J.2878, and in H.Q.426 when it becomes infected. There are indications that Q.45 may also be severely affected. The disease has not yet been seen in Q.28, Co.290, and M.1900 Seedling.

After the outbreak in 1930 and the following few years, farmers, on the advice of the Bureau, ceased planting P.O.J.2714 in the "dwarf area." Later P.O.J.213, P.O.J.2878 and Malagache were deleted from the list of approved varieties for the "dwarf area," while H.Q.426 and E.K.28 are no longer extensively grown there. Because of the serious downy mildew outbreak some years ago, the planting of P.O.J.2878 was prohibited over a large portion of the Mackay area. Energetic control measures, however, brought about the disappearance of the disease, and two years ago P.O.J.2878 was re-introduced. Although no downy mildew has been recorded, dwarf infection was again noticed in this variety last February. Since then the Mackay Cane Pest and Disease Control Board has conducted a preliminary survey to determine the extent and severity of the disease.

During the past three months dwarf has been found on twenty farms, in P.O.J.2878, H.Q.426, Q.45, E.K.28, Q.20, Comus and a Bureau seedling cane under test. On some farms, only two or three diseased stools have been found and during the past season natural spread has been negligible or very light. However, if P.O.J.2878, and possibly Q.45, are grown extensively in the "dwarf area", the disease may develop, when conditions are suitable, into a major problem necessitating an expensive control effort. On the forest lands concerned, these two varieties have no outstanding attributes except grub resistance under irrigation. In view of the threat from dwarf, plantings of these varieties should not be extended on such lands.

Cane from diseased planting material and ratoons from previously diseased stools are called primary dwarf. Stalks contracting the disease at other times are known as secondary dwarf infection.

When diseased cuttings of varieties, susceptible to severe damage, are planted, primary dwarf usually appears as a stunted stool of grass-like shoots which form no cane and represent a total loss (Fig. 15 left stool). However, under similar conditions some varieties may make much more growth and show some stalks of millable cane (Fig. 15 right stool). In the "dwarf area", diseased stools are remarkably persistent and survive harsh growing conditions.

Symptoms of secondary dwarf in varieties P.O.J.2878 and P.O.J.2714 are as follows:—The first signs of the disease under good growing conditions are faint markings similar to mosaic in the "cabbage." Within three weeks narrow stripes one eighth to two inches long, running in the direction of the leaf veins, appear, and the leaves become stiff and erect. Similar leaf markings are often found also in stools affected with primary dwarf. Stalk growth in secondary dwarf usually decreases or ceases altogether, and some tapering may occur (Fig. 16).

FIG. 15.—On left, primary dwarf in a variety which shows little tolerance to the disease (HQ.426); on right, primary dwarf in a more tolerant variety (Malagache). Photograph taken when both stools were 21 months old.

Symptoms and behaviour of the disease may vary considerably within the same variety, and between different varieties under different conditions. For example, during autumn, the only symptoms of dwarf in some varieties is a slight stiffening of the leaves with few or no leaf markings, and with leaf colour varying from pale green to a green which is darker than normal.

The origin and method of spread of this disease still remain a mystery. Field observations and surveys prove that natural spread is greatest during hot wet conditions in summer, but in drier years is confined to low lying, poorly drained fields or patches of cane. Over the past twelve years primary dwarf in susceptible varieties has been found outside the "dwarf area" in the districts of Oakenden, Te Kowai, Palms and Meadowlands. Evidently the disease was brought there in diseased planting material, for although weather conditions suitable for spread have since been experienced no secondary dwarf has been recorded in spite of careful and lengthy observations.

Control.

1. Any farmer in the Mackay district who suspects the presence of dwarf disease in his cane should notify the Mackay Cane Pest and Disease Control Board.

FIG. 16.—Stalk of P.O.J.2714, illustrating fan-like top which follows secondary infection.

2. Plantings of susceptible varieties should be reduced to a minimum in the "dwarf area." The varieties P.O.J.2878 and Q.45 should not be planted in low lying fields which are normally poorly drained, or in fields which are likely to remain wet over a long period during a protracted rainy season.

3. No field of susceptible varieties in the "dwarf area" should be used as a source of plants until it has been inspected and approved by Board Inspectors, because, although most primary dwarf is obvious, many secondary infections may be missed quite easily, particularly during autumn and winter when plants are being selected.

Failure to observe these precautions may cause extensive spread of this disease and force a restriction of varieties now available for planting.

A Method of Applying Sulphate of Ammonia.

Under mechanised farming conditions, applying sulphate of ammonia sometimes constitutes a problem. A number of methods have been tried and one type of farm-built tractor attachment used by a Pleystowe grower for single row work is illustrated in Figs. 17 and 18. The chute outlet is arranged as low as possible to protect the tractor from

FIG. 17.—Front view of tractor attachment for applying sulphate of ammonia.

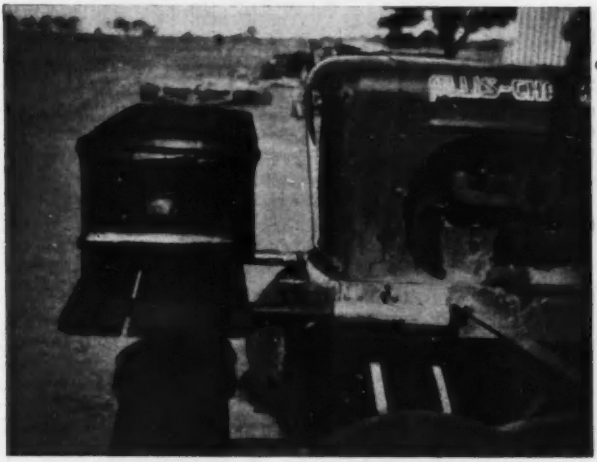

FIG. 18.—Side view of tractor attachment for applying sulphate of ammonia.

contact with the fertilizer which would cause corrosion. While working a grubber attachment, ammonia has been applied with this fitting at the rate of two cwt. per acre to 16 acres, per eight-hour day.

This simple attachment overcomes the old method of top-dressing by purely manual labour and serves a dual purpose in that the field is top-dressed and cultivated in the one operation.

J.T.E.

Cultures for the Inoculation of Green Manure Crops.

Green manuring is now well established as an essential part of the good farmer's crop routine, but the fact remains that, on many occasions the legume, be it cowpea or bean, or any other member of the same family, does not grow as vigorously as it should. It is common knowledge that legumes have small lumps, or nodules, on their roots and that it is through the agency of these nodules (and the bacteria living inside them) that the plant is enabled to secure its own nitrogen fertilizer. Plants of other families, in order to grow well, must have the nitrogen-containing compound applied externally—with sugar cane for instance, this is usually done by a dressing of ammonium sulphate, sodium nitrate, or blood and bone, and the crop responds with greener leaves and increased yield. The legume, however, possesses in its nodules the wherewithal to manufacture its own nitrogen fertilizer and when the plants eventually die and decay, the nitrogen is available in the soil for the succeeding crop.

All except the most barren soils contain some bacteria capable of forming nodules on the roots of legumes, but it is only the land which has grown a good crop of the *same green manure* that will have present the most efficient nitrogen users. This fact, although the reason behind it was unknown, was well recognised many years ago, and old text books on agriculture tell the farmer to get a dray-load of soil from a fertile field when planting a legume on fresh ground. The right bacteria were thus spread on fresh ground and the young seedlings soon took them into partnership and a good crop resulted. In modern times, however, we have been able to grow these bacteria in bottles in the laboratory, and so have on hand the proved best bacteria for each particular legume. The Bureau maintains a stock of these, and farmers should take full advantage of it—the price is so low, and so little trouble is involved, that the inoculation of all legume seeds planted should be a routine matter, as an insurance that the right bacteria are there.

Farmers are requested to write to the Bureau for bottles of the legume bacteria, but in the application it should be stated what crop is to be sown, and the quantity and date. A postal note for one shilling should accompany each order and to save delay at seeding time, orders should be placed some time before sowing. Full instructions for use come with the bottles and should there be any hold up on the farm, the bacteria will remain alive for one month.

C.G.H.

A. H. TUCKER, Government Printer, Brisbane.